



Reducing Oil Use and CO₂ Emissions by Informing Consumers' Fuel Economy Decisions: The Role for Clean Cities

*A Discussion Paper For Clean Cities Coalitions And
Stakeholders To Develop Strategies For The Future*

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1. INTRODUCTION

Increasing the energy efficiency of motor vehicles is critical to achieving national energy goals of reduced petroleum dependence, protecting the global climate and promoting continued economic prosperity. Even in the presence of fuel economy and greenhouse gas emissions standards and various economic incentives for clean efficient vehicles, providing reliable and accurate fuel economy information to the public is important to the efficient functioning of the marketplace. This paper reviews the current status of fuel economy information and Clean Cities' role in disseminating that information, and identifies challenges and opportunities for the future.

The DOE Clean Cities Program fulfills the Department of Energy's (DOE) statutory responsibility to provide fuel economy information to the public in collaboration with the Environmental Protection Agency (EPA) (49 USC 32908, 2006). Historically, this effort consisted solely of the compilation, publication and distribution to new car dealers of the Gas Mileage Guide (later renamed the *Fuel Economy Guide*). Dealers were required to prominently display the guides and to have copies available for customers to take away. Reviews of the program indicated that there were compliance issues and that in any case, awareness of the guide and its impact on new car purchase decisions was very limited (Larson and Hill, 1990). Consumers showed much greater awareness of fuel economy labels and MPG estimates used in manufacturers' advertisements. From a peak publication of 15 million copies per year in the late 1970s, distribution of the guide decreased to 3 million per year in the 1980s.

Recognizing the rapid changes in information technology, in 1999 the DOE and the EPA introduced a website, www.fueleconomy.gov as a new venue for disseminating fuel economy information. The website not only provides access to fuel economy estimates for new vehicles but for all used light-duty vehicles back to model year 1984. Methods of market research, chiefly focus groups, were used to guide the design and content of the website. The website quickly eclipsed the printed guide as a source of information for consumers. From 400 thousand user sessions¹ in 1999, traffic exploded at an average annual rate of 50%, topping 30 million user sessions in 2008 (Figure 1). By contrast, the number of fuel economy guides distributed for model year 2009 included 250,000 printed copies plus and estimated 300,000 downloads of fuel economy guides from the website. The new information technology landscape was formally recognized by a change in the requirements for fuel economy information established in an EPA rulemaking in 2006 (U.S. EPA, 2006a). The new rules relaxed the requirements for dealerships to distribute hardcopies of the guide while emphasizing information dissemination via the internet.

The Clean Cities Fuel Economy Information Project strives for continuous improvement and innovation to serve consumers and help achieve national energy goals. Based on web traffic

¹ One user session consists of a single a visit to the site by an individual. One user session will typically generate dozens to hundreds of hits. The average length of a user session on fueleconomy.gov has remained very nearly constant over time at about 10 minutes.

attracted, the four most successful innovations have been the following:

- Find-a-car – a feature that allows consumers to quickly and easily compare up to four alternative vehicles side-by-side in terms of their fuel economy, fuel cost, greenhouse gas emissions and energy security.
- Your MPG – a feature that allows users to share their real-world MPG experience with others.
- Driving and Maintenance Tips – an authoritative source of information on safe and cost-effective measures motorists can take to maximize real world fuel economy.
- MotorWeek Fuel Economy Features – public television programming to provide consumers information about fuel economy and alternative fuel vehicles in an appealing, accessible format.

Mobile internet-connected devices are becoming an increasingly important information source. In 2007, a mobile version of fueleconomy.gov, www.fueleconomy.gov/m, was introduced to provide fuel economy information to the mobile internet market.

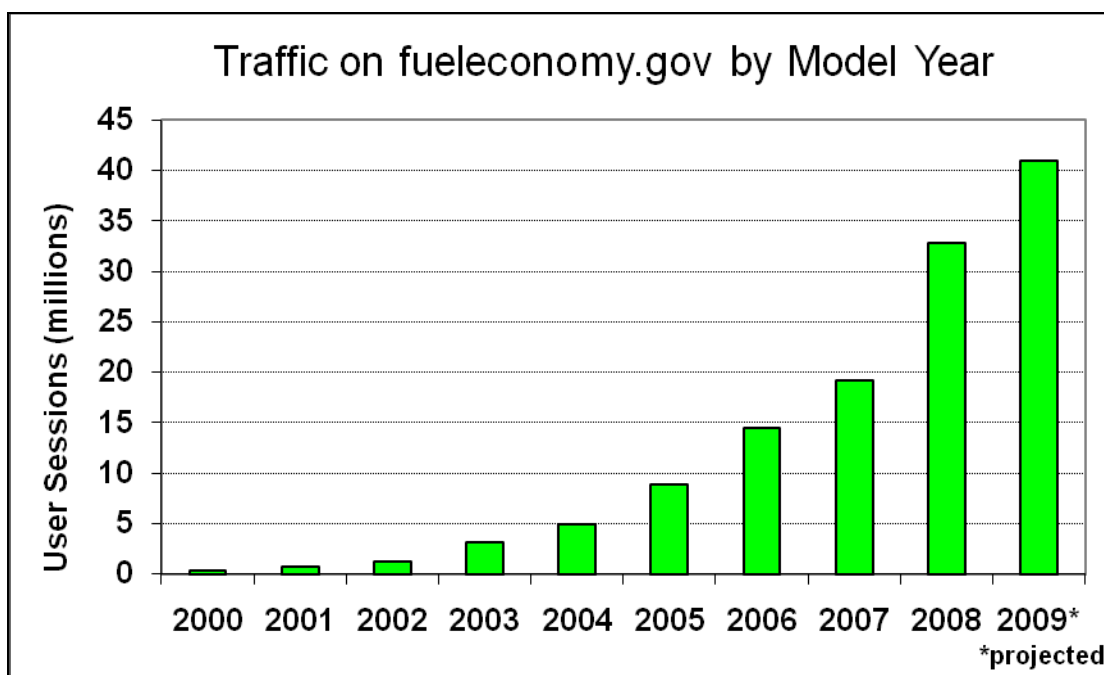


FIGURE 1. User sessions hosted by www.fueleconomy.gov by model year (Sept.-Oct.).

The future poses new challenges. With rising incomes and increasing fuel economy levels, each additional mile per gallon becomes less valuable to motorists. At the same time, world oil markets continue to tighten (as evidenced by oil prices above \$70/barrel during the current global recession) and the need to reduce greenhouse gas emissions grows more urgent. Recent research suggests that a key reason consumers appear to undervalue fuel economy improvements is uncertainty about the value of future fuel savings (Greene, German and Delucchi, 2009). Perhaps the most significant factor, even greater than uncertainty about future fuel prices, is uncertainty about the fuel economy a vehicle will achieve in real-world use. The challenge of providing

consumers with fuel economy estimates that are more accurate for each individual, as opposed to unbiased in general is perhaps the greatest challenge for the future.

2. ISSUES AND TRENDS IN MOTOR VEHICLE FUEL ECONOMY

After two decades of stagnation, new vehicle fuel economy is rising again (Figure 2). A rulemaking by the Department of Transportation (DOT) set higher standards for light trucks in 2003 and again in 2006 (U.S. DOT/NHTSA, 2006). The new rulemaking will, for the first time, subject heavier light trucks – those with a gross vehicle weight between 8,500 and 10,000 lbs. – to fuel economy standards and labeling requirements beginning in 2011 (71 FR 77872). In December of 2007, Congress enacted the Energy Independence and Security Act, establishing a fuel economy target of 35 MPG for 2020. An agreement between the DOT, the EPA, the State of California and the Automobile Industry in 2009 will lead to a joint standard for greenhouse gas (GHG) emissions and fuel economy equivalent to approximately 35 MPG for passenger cars and light trucks by 2016 (The White House, 2009).² This new agreement recognizes the authority of both the EPA and the State of California to set greenhouse gas emissions standards for motor vehicles and attempts to coordinate governments' efforts to regulate fuel economy and greenhouse gas emissions.

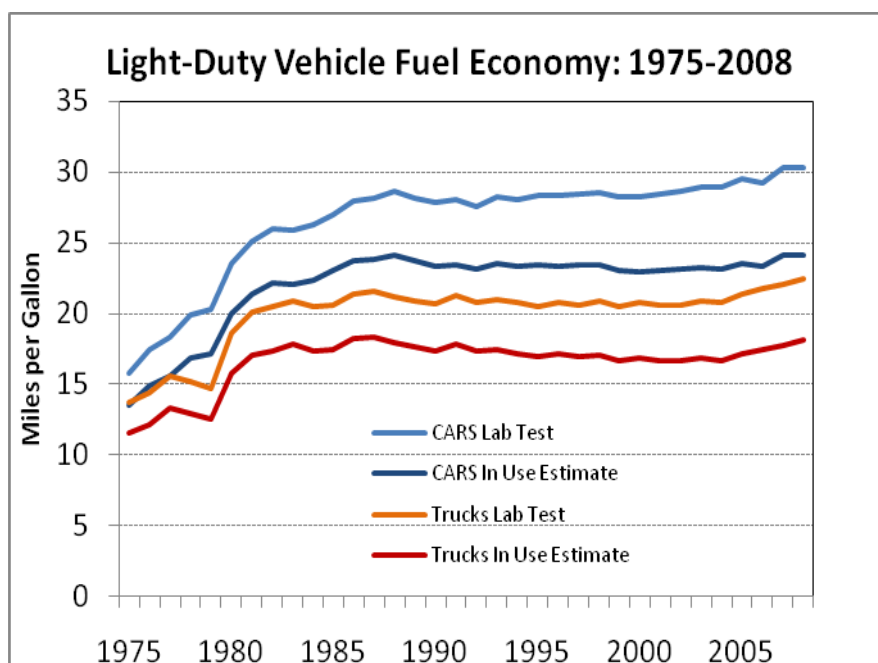


Figure 2. Fuel economy of new light-duty vehicles as measured by the combined federal tests (Source: U.S. EPA, 2008, table 1).

Fuel economy improvement has a proven track record of reducing oil dependence while saving

² The new standard will allow credits for improvements to air conditioning systems and other factors that will result in an effective fuel economy requirement of approximately 33 MPG by 2016.

consumers money. The improvements in fuel economy over 1975 levels now save U.S. motorists in excess of 80 billion gallons of gasoline each year, more than \$200 billion dollars at today's gasoline prices (\$2.50/gallon) (Figure 3). U.S. petroleum consumption today is more than 5 million barrels per day lower than it would have been at 1975 fuel economy levels. The savings from improved fuel economy are equal to our entire domestic petroleum production. In 2008 the United States produced just under 5 million barrels per day of crude oil.

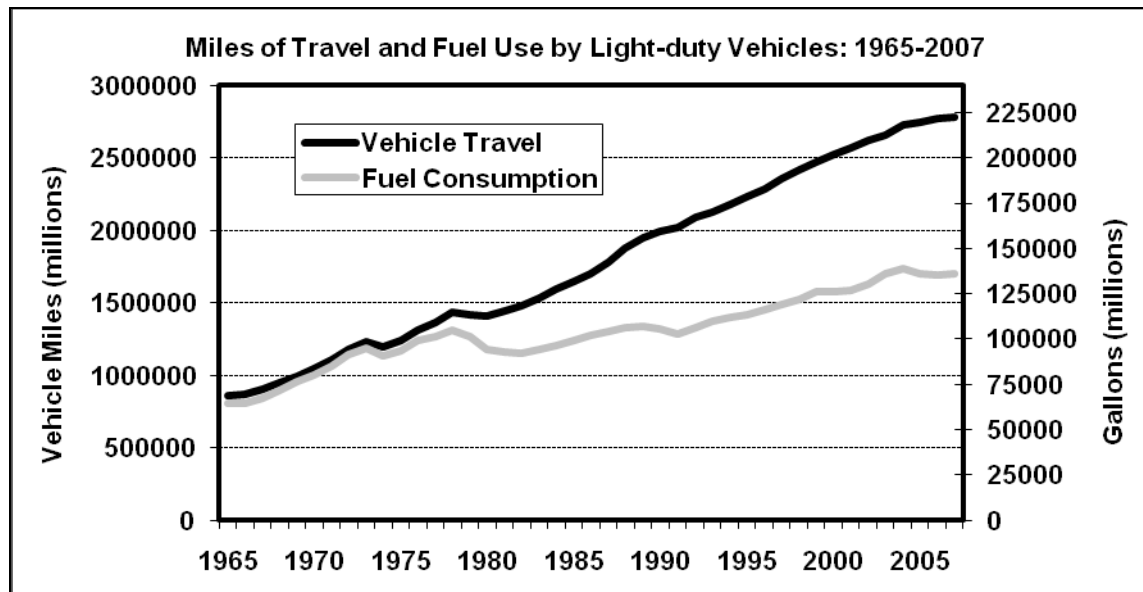


Figure 3. Trends in U.S. light-duty vehicle travel and fuel use (Source: U.S. DOT/FHWA, 2007, table VM-1).

In December 2006 the EPA established new procedures for estimating the fuel economy numbers reported to the public on new car fuel economy labels and in the *Fuel Economy Guide* (71 FR 77872). The new procedures do not affect the measurement of fuel economy for purposes of determining manufacturers' compliance with fuel economy standards. The new procedures are based on five test cycles rather than two, and add cycles that reflect (1) more aggressive and higher speed driving, (2) use of air conditioners, and (3) engine warm-up during cold temperatures. The new numbers lowered previously reported fuel economy estimates by approximately 10-15%, on average. At the time the rule was implemented relatively few vehicles were tested on all five cycles. A temporary correction procedure based on the original (city and highway) tests was used derive new fuel economy estimates for most vehicles. The fueleconomy.gov website played a key role in explaining the new system to the public and the media. Providing information via an on-line electronic data base allowed the correction procedures to be applied to all vehicles, new and used, simultaneously, insuring consistency in the publicly available data and thereby avoiding much of the confusion that would otherwise have occurred in comparing the fuel economy new and used vehicles.

3. RECENT RESEARCH ON FUEL ECONOMY INFORMATION AND CONSUMERS' VEHICLE CHOICES

Despite the importance of fuel economy to the nation's energy security and greenhouse gas mitigation, there is relatively little published research on the market for fuel economy and how consumers use fuel economy information in their vehicle purchase decisions. The Clean Cities Fuel Economy Information project has conducted market research and sponsored university research that has produced significant breakthroughs in our understanding of the market for fuel economy.

- Focus group research revealed a wide variety of views about the importance of fuel economy in car purchase decisions and confirmed that those who do consider fuel economy do so chiefly for private economic rather than environmental or energy security concerns (Nye et al., 2003).
- In-depth survey research carried out by the University of California at Davis revealed that consumers do not, in general, make quantitative assessments of the value of improved fuel economy as economic theory would suggest (Turrentine and Kurani, 2007). Although most households have estimates of their own vehicles' miles per gallon and know the cost of a tank of gasoline, few know how much they spend on fuel in a year. None of the households in the study had ever estimated lifetime fuel savings due to MPG differences when comparing vehicles they were considering purchasing.
- An analysis of in-use fuel economy data for a sample of over 3,000 vehicles indicated that the EPA combined city/highway fuel economy estimates, adjusted for the shortfall between test procedure values and real world experience, were very nearly unbiased estimators of fuel economy estimates reported by individuals for over 3,000 vehicles (Greene et al., 2006). The accuracy of the EPA adjusted fuel economy estimates for any particular vehicle was poor, however, with a 95% confidence interval of +/- 7 MPG. Taking into account an individual's own distribution of stop-and-go versus highway driving improved the accuracy of the adjusted combined estimator by 15%.
- Researchers at Duke University showed that consumers are confused about the relationship between fuel economy (miles per gallon) and fuel consumption (gallons per mile), and that this contributes to inaccurate assessments of the value of fuel economy (Larrick and Soll, 2008).
- Application of the Nobel Prize winning theory of loss aversion to the market for fuel economy demonstrated that uncertainty about the value of future fuel savings combined with typical loss averse behavior was sufficient to explain consumers' apparent undervaluing of fuel economy (Greene, 2009). This phenomenon can lead to an undervaluing of future fuel savings by a factor of two or more. The most significant source of uncertainty was not future fuel prices but rather the accuracy of official fuel economy estimates in predicting the actual fuel economy an individual would experience.

Recent research suggests that it is highly unlikely that the market for fuel economy is efficient. The inference that due to uncertainty and loss aversion consumers are likely to significantly undervalue future fuel savings relative to their expected value is entirely consistent with

unofficial statements by automobile manufacturers and with independent survey evidence indicating that consumers require short payback periods on the order of 2-4 years for investments in better fuel economy (Greene, German and Delucchi, 2009). This theory can also explain Turrentine and Kurani's (2003) findings that consumers, in general, do not quantitatively evaluate the value of fuel savings when making vehicle purchase decisions. Manufacturers, on the other hand, must invest billions of dollars in the kinds of changes to engines, transmissions, accessories, materials, aerodynamics and rolling resistance that can achieve significant fuel economy improvements. Given consumer indifference, there is little reason for manufacturers to make such large capital investments or even to invest fully in research and development. The key lesson for fuel economy information is that providing consumers with information that can reduce their uncertainty about future fuel savings is likely to improve market performance. In this respect, consumers would benefit more from fuel economy estimates that are more accurate for individuals than from estimates that are less biased for the population as a whole. Previous research on this question and past rulemakings have focused on bias rather than accuracy.

The recent research should not be interpreted to imply that consumers do not respond to higher fuel prices by choosing more efficient vehicles. There is substantial econometric evidence that when fuel prices rise car buyers downsize, trade off performance for fuel economy and generally pay greater attention to fuel economy in their purchase decisions (e.g., Espey and Nair, 2005; Allcott and Wozny, 2009; Langer and Miller, 2008). The econometric evidence, however, is contradictory with some studies indicating that consumers fully value future fuel savings and others supporting the theory of uncertainty and loss aversion and the empirical evidence from surveys and focus groups. If the market for fuel economy is inefficient, as the balance of evidence indicates, the market will still respond to higher fuel prices but the response will be significantly attenuated. In addition to policies such as fuel economy standards and feebates, better information about the value of fuel economy for individual consumers can make a significant contribution to improving the efficiency of the market for fuel economy.

4. CURRENT STATUS OF FUEL ECONOMY INFORMATION

Today, fuel economy information is available to consumers from a variety of sources:

- www.fueleconomy.gov
- www.fueleconomy.gov/m (mobile site)
- Other online automotive information sites such as Edmunds and Kelley Blue Book
- Newspapers and magazines such as Consumer Reports
- TV advertisements and programs
- New car fuel economy labels

4.1 EPA FUEL ECONOMY RATINGS

The predominant source for fuel economy estimates is the EPA's certification tests. The official EPA estimates are not only used on new car labels but in the *Fuel Economy Guide*,

www.fueleconomy.gov, nearly all online automobile information websites, in manufacturers' TV ads, and in the printed media. The only other widely available alternative estimates are Consumer Reports' own mileage ratings and the publicly supplied estimates contained in [fueleconomy.gov](http://www.fueleconomy.gov)'s "Your MPG" data base. The EPA data are available for many more vehicles than either Consumer Reports or Your MPG, and are made available in a timely manner at the beginning of each model year. As a consequence they are by far the most widely used source of fuel economy information.

The EPA tests, developed in the 1970s, measure fuel economy under controlled conditions in a laboratory using a standardized test procedure specified by federal law. Manufacturers test their own vehicles—usually pre-production prototypes—and report the results to EPA. EPA reviews the results and confirms about 10-15 percent of them through their own tests at the National Vehicles and Fuel Emissions Laboratory. In the laboratory, the vehicle's drive wheels are placed on a machine called a dynamometer that simulates the driving environment—much like an exercise bike simulates cycling. The energy required to move the rollers can be adjusted to account for wind resistance and the vehicle's weight. On the dynamometer, a professional driver runs the vehicle through a standardized driving routine, or schedule, which simulates "typical" trips in the city or on the highway. Each schedule specifies the speed the vehicle must travel during each second in the test. A hose is connected to the tailpipe to collect the engine exhaust. The carbon in the exhaust is measured to calculate the amount of fuel burned during the test, which is more accurate than using a fuel gauge.

By 1982, researchers had determined that the fuel economy numbers vehicles were achieving on the road were substantially lower than the test values (McNutt et al., 1982). After extensive data collection and statistical analysis, the EPA published official on-road correction factors: (Hellman and Murrell, 1984). These factors reduced the city cycle fuel economy estimates by 10% and the highway cycle estimates by 22%, for an overall downward adjustment of 15% on average.

4.2 CHANGE IN EPA RATINGS

In its 2008 fuel economy rulemaking the EPA also established new requirements for new car dealers to display and provide fuel economy guides to the public (40 CFR 600.405-08). The new rules allowed dealers to provide either printed copies of the Gas Mileage Guide or to provide access to www.fueleconomy.gov via an on-site computer available to the public.

The EPA also developed new test procedures to better represent the driving conditions consumers experience today. The old tests, originally developed in the 1970s, used lower speeds and acceleration rates than are commonly seen on today's roads. The highway test, for example, had a top speed of 60 mph and an average speed of 48 mph. The tests were also conducted under mild climate conditions (75° F) and without the use of accessories, such as air conditioning.

The new testing methodology combines the original city and highway tests with three new driving cycles:

1. A high-speed test that includes faster speeds and acceleration rates. The new test has a maximum speed of 80 mph and a maximum acceleration of 8.46 mph/sec, compared to 3.2 mph/sec in the original highway test.
2. A test that accounts for air conditioning use under hot outside conditions (95° F sun load)
3. A cold-temperature test that measures the effects of colder outside temperatures (20° F) on cold-start driving in stop-and-go traffic

The results from these new tests are used to adjust the estimates from the original city and highway tests.

EPA estimates that, for conventional vehicles, the new tests result in an average drop of about 10-20 percent for city mpg ratings and 5-15 percent for highway ratings. For hybrids, the new test methods should result in a 20-30 percent mpg drop compared to the old method, while highway ratings should drop by an amount similar to that for conventional vehicles (U.S. EPA, 2006b).

4.3 UNBIASED BUT INACCURATE

In December of 2006 the EPA introduced new official fuel economy estimates. On average, the new estimates are 10-20% lower than previous estimates for the city cycle and 5-15% lower for the highway cycle. In developing the new method the EPA was responding to criticism from media sources and to a request from the Congress to develop new, more representative estimates. Data provided by users of www.fueleconomy.gov's Your MPG feature, however, indicate that the previous EPA combined adjusted MPG numbers were unbiased estimators of the in-use MPG obtained by the typical motorist (Figure 4). A regression analysis of reported in-use MPG as a function of the combined adjusted MPG based on EPA's previous methods indicates that in-use MPG is approximately 2% higher than the EPA adjusted estimate and has an intercept of very nearly zero. If the EPA estimates were perfectly unbiased, they would fall symmetrically around a straight line passing through the origin with slope of 1, as illustrated by the blue line in Figure 4. In fact, the fitted regression line is very close to the hypothetical blue line, indicating that the old estimates were remarkably unbiased predictors of the fuel economy real consumers achieved on the road.

On the other hand, there is enormous scatter about the regression line. The scatter implies that the estimates based on the old method EPA are inaccurate, albeit unbiased, predictors of what individuals will achieve on the road. These data shed new light on consumers' dissatisfaction with the official EPA numbers. About half of the public will get worse MPG than the official numbers predict and a large fraction will get much worse MPG. It is unlikely that much of the deviation is due to differences in the manufacture of vehicles. Nearly all of it is likely due to how, where and under what conditions vehicles are operated. This suggests that the route to improving MPG information lies in developing individualized estimates that take into account as many of these factors as possible.

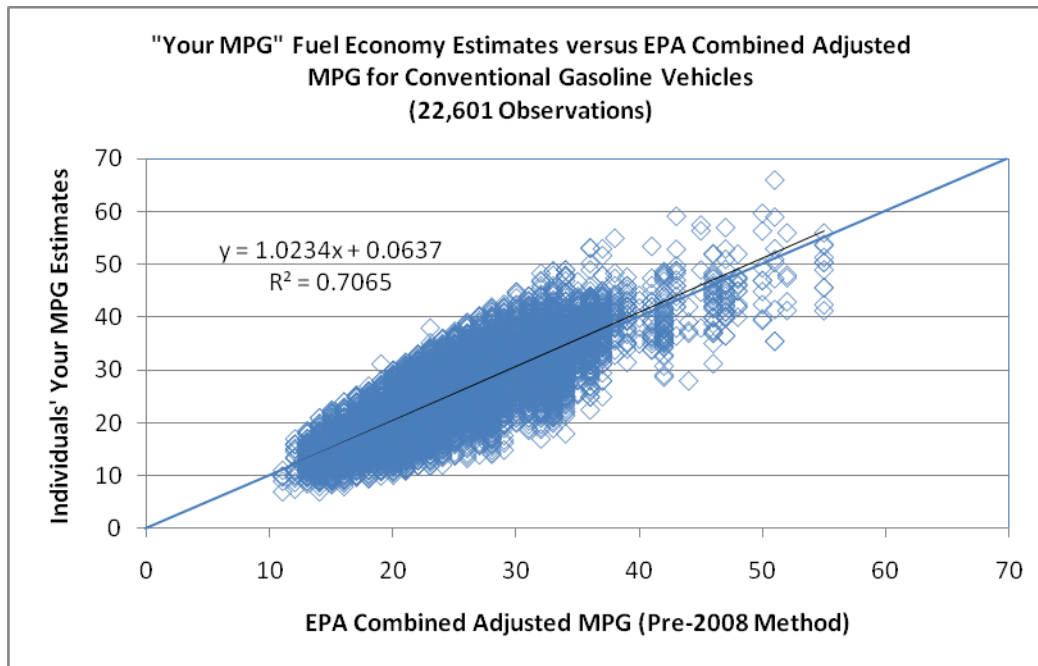


Figure 4. “Your MPG” fuel economy estimates v. EPA adjusted MPG for conventional gasoline vehicles.

5. FEDERAL INCENTIVES

The U.S. government is currently promoting light-duty vehicle fuel economy through several federal incentives that reward consumers for making fuel efficient choices when purchasing a new vehicle.

5.1 CASH FOR CLUNKERS

The most widely publicized federal incentive was the Car Allowance Rebate System (CARS) program, also known as “Cash for Clunkers.” CARS was a \$3 billion program, established by the Consumer Assistance to Recycle and Save Act of 2009 (P.L. 111-32), with the combined goals of helping the struggling automotive industry and improving fuel economy. The program offered rebates of \$3,500 and \$4,500 for consumers that traded-in their current, inefficient vehicle for a new more-efficient one.

Most trade-in vehicles were required to have an EPA combined fuel economy rating of 18 mpg or less, and new vehicles were required to have a combined rating of 22 mpg or better for passenger cars and 15 to 18 mpg or better for light trucks. Trade-in requirements for larger trucks, vans, and SUVs were based on age and gross vehicle weight rating (GVWR), since official EPA fuel economy ratings for these vehicles do not exist. The average MPG of the 700,000 vehicles traded in under the program was 15.8 MPG while the average MPG of new vehicles purchased was 24.9, a 58% increase (U.S. DOT, 2009). Given this difference in fuel

economy, if each vehicle were driven 10,000 miles per year, a single year's fuel savings would amount to over 150 million gallons.

The program lasted only from July 24 to August 24, 2009. However, it was wildly popular with consumers, who ran through the first \$1 billion in funding in just under a week. It is still too early to know the full impact of the program, but a few preliminary statistics are available.

The Clean Cities Fuel Economy Information Program played a key role in the Cash for Clunkers program by providing the official web functionality and database used by consumers to determine whether their trade-in and intended purchase qualified for a CARS incentive and, if so, how much. The data base was also used by NHTSA staff to validate the Cash for Clunkers deals submitted by car dealers. The official CARS website linked directly to a www.fueleconomy.gov site that was designed to have the identical look and feel of the NHTSA CARS site. Unless consumers and dealers noted the change in URL they would be unaware they were working on fueleconomy.gov. Millions of additional users took advantage of this capability in the month leading up to the CARS program and in the month during which the program was in effect.

5.2 ENERGY POLICY ACT OF 2005: ALTERNATIVE MOTOR VEHICLE TAX CREDITS

The Energy Policy Act of 2005 (P.L. 109-58) provides federal income tax credits for consumers who purchase new hybrid-electric vehicles (HEVs), fuel cell vehicles (FCVs), alternative fuel vehicles (AFVs), and vehicles using advanced lean-burn technology (such as diesels) beginning January 1, 2006. This incentive is aimed at helping advanced fuel-efficient and alternative fuel technologies gain acceptance in the marketplace by helping offset the increased cost of these technologies to consumers. These credits replaced earlier federal tax deductions that ended December 31, 2005.

Hybrid Tax Credit. The hybrid credit allows up to \$3,400 for the purchase of a qualifying new hybrid vehicle up to 8,500 lbs. GVWR. The amount varies among hybrid models depending upon two variables:

1. The vehicle's fuel economy improvement relative to 2002 model year city fuel economy for the vehicle's inertia weight class (\$400 to \$2,400 credit)
2. It's projected lifetime fuel savings (\$250 to \$1,000 credit)

These credits are to be phased out for each manufacturer after it sells 60,000 hybrids, tabulated from January 1, 2006.

As of August 25, 2009, about 51 hybrid models from seven manufacturers have been certified by IRS for hybrid vehicle credits. Credits for two manufacturers, Toyota and Honda, have already phased out. Credits for Ford hybrids began phase-out on April 1, 2009, and will end April 1, 2010. This tax credit will end for all manufacturers as of December 31, 2010.

Lean Burn (Diesel) Tax Credit. The lean-burn credit is almost identical to the one for hybrids. It allows a credit of up to \$3,400 based on the same fuel economy and conservation criteria, and it has the same phase-out provisions.

Manufacturers have been much slower to introduce vehicles that qualify for this credit due to the difficulty of designing diesel engines capable of meeting stringent Bin 5 Tier II emissions standards. No vehicles were certified for this credit by IRS until the 2009 model year. As of August 25, 2009, nine vehicles from three manufacturers have been certified by IRS for this credit. To date, no manufacturer has sold enough lean burn vehicles to begin credit phase out.

New Qualified Alternative Fuel Motor Vehicle Credit. The AFV credit is not based on fuel economy improvement, but rather the incremental cost of the technology over a similar conventional vehicle, up to a maximum of \$5,000 for vehicles with a GVWR of 8,500 lbs. or less. For this credit, “alternative fuel” means compressed natural gas (CNG), liquefied natural gas (LNG), liquefied petroleum gas (LPG), hydrogen, or any liquid that is at least 85 percent methanol by volume.

Like the hybrid and lean burn credits, the AFV credits apply to vehicles placed in service from January 1, 2006 to December 31, 2010. However, the AFV credits do not phase out based on manufacturer sales.

Thus far, only one vehicle model has been certified by IRS for this credit, the Honda Civic GX, which was approved for model years 2005 through 2009.

New Qualified Fuel Cell Motor Vehicle Credit. This legislation allows a total credit of up to \$12,000 for qualifying fuel cell vehicles with a GVWR of 8,500 lbs. or less placed into service after December 31, 2005. This credit is composed of two parts: a fixed credit of \$8,000 (\$4,000 if the vehicle is purchased after December 31, 2009) plus an additional \$1,000 to \$4,000 for fuel economy improvements of 150 to 300 percent over 2002 model year city fuel economy for the vehicle’s inertia weight class. Qualifying vehicles must meet stringent Bin 5 Tier II emissions standards. Although this credit is available for vehicles placed in service from January 1, 2006 to December 31, 2014, IRS has not certified any such vehicles for this credit to date.

5.3 PLUG-IN ELECTRIC DRIVE MOTOR VEHICLE CREDIT

Section 205 of the Emergency Economic Stabilization Act of 2008 (P.L. 110-59) established a tax credit for plug-in electric drive motor vehicles. The incentive is a tax credit of \$2,500 plus \$417 for each kilowatt hour of traction battery capacity in excess of 4 kilowatt hours. The total credit cannot exceed \$7,500 for a vehicle with GVWR of 10,000 lbs. or less. This credit applies to qualifying vehicles purchased after December 31, 2008, and begins to phase out after a total of 250,000 such vehicles have been sold in the United States to date, no such vehicles have been certified for the credit by IRS.

5.4 HIGH OCCUPANCY VEHICLE (HOV) WAIVER

Section 1121 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act of 2005 (P.L. 109-59) and subsequent guidance from EPA (U.S. EPA, 2007) allow states the discretion to open up their HOV lanes to fuel-efficient and low-emissions vehicles regardless of the number of passengers as long as the vehicle is:

- A dedicated alternative fuel vehicle, or
- A hybrid vehicle achieving 50 percent or better in-city fuel economy or 25 percent or better in combined city/highway fuel economy compared to a similar gasoline fueled vehicle.

To be eligible, the vehicles must also meet Bin 5 Tier II federal emissions standards or California LEV II standards. States can opt to toughen EPA's criteria but may not reduce them. Currently, eleven states (including DC) allow HOV lane access for energy efficient and/or alternative fuel vehicles (U.S. DOE, 2009).³ The provision expires September 30, 2009.

5.5 STATE AND LOCAL INCENTIVES

In addition to federal incentives, many states and local governments offer incentives to encourage consumers to purchase fuel-efficient vehicles. State incentives include access to HOV lanes, state tax credits, exemptions from vehicle excise taxes, and exemptions from mandatory emissions testing. Local incentives include such perks as free parking at designated locations and free or reduced-rate charging for electric vehicles.

6. BENEFITS

Improved fuel economy saves consumers money, reduces the nation's dependence on petroleum and benefits the environment by reducing emissions of carbon dioxide, the most important greenhouse gas. Even for similar vehicles of the same size class, the money saved by choosing a more efficient vehicle can be substantial. For example, comparing model year 2010 midsize sedans using fueleconomy.gov's "Find-a-Car" feature, one finds that a 4-cylinder Mazda 6 with automatic transmission averages 24 miles per gallon (Figure 5). If gasoline costs \$2.50 per gallon, the cost of fuel to drive 25 miles would be \$2.60, and total annual fuel costs for 15,000 miles of typical driving would cost \$1,563. A Ford Fusion Hybrid getting 39 miles per gallon would cost only \$1.60 in fuel to drive 25 miles and would run up an annual fuel bill of \$962 for 15,000 miles of travel. The Toyota Prius Hybrid rated at 50 miles per gallon requires only \$1.25 in gasoline to go 25 miles and would require only \$750 in gasoline for 15,000 miles of driving, less than half the fuel bill of the Mazda 6.

³ U.S. Department of Energy, Alternative Fuels & Advanced Vehicles Data Center. (http://www.afdc.energy.gov/afdc/progs/in_matrix.php). Viewed 26 August 2009.



Figure 5. Fuel savings benefits of higher fuel economy for three midsize cars:
www.fueleconomy.gov

7. REDUCING PETROLEUM DEPENDENCE

Just as past fuel economy improvements have saved enormous quantities of petroleum, the standards recently agreed upon through 2011 will reduce U.S. petroleum demand significantly. Figure 6 compares two projections by the Energy Information Administration, one developed in 2007 and the other in 2009 reflecting the impacts of fuel economy standards and higher fuel prices. The 2009 projection which includes the impacts of higher fuel economy standards and the market response to higher fuel prices reduces light-duty vehicle fuel use by an estimated 2.9 million barrels per day in 2030 (44 billion gallons per year).

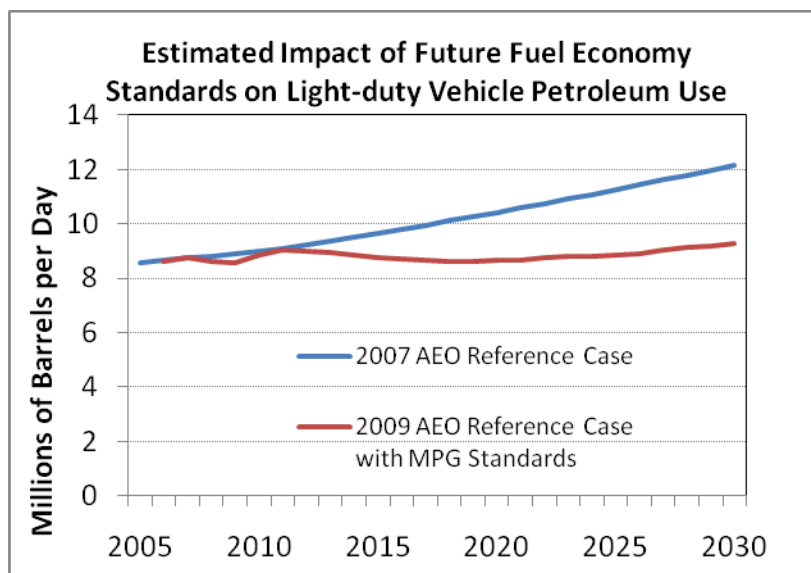


Figure 6. Estimated impacts of future fuel economy standards (Source: U.S. DOE/EIA, 2007 & 2009, table 7).

The Clean Cities Fuel Economy Information Project has developed estimates of its own impact on petroleum consumption in the United States. The method begins with hard data on the number of visitors to the www.fueleconomy.gov website, the number of Gas Mileage Guides distributed, and incomplete information on media coverage of the website by TV, radio, other websites and printed media. Whenever possible, published estimates of the impacts of such information on consumer behavior are used to translate the transmission of information into changed consumer behavior or the operating efficiency of vehicles. In other cases conservative assumptions about impacts are used link information dissemination to outcomes. In general, much of the information necessary to rigorously link project activities to real world fuel consumption is lacking or out of date. Nonetheless, using the best information available, it is estimated that the Clean Cities Fuel Economy Information Project helped consumers save over 400 million gallons of petroleum in 2008 (Figure 7).

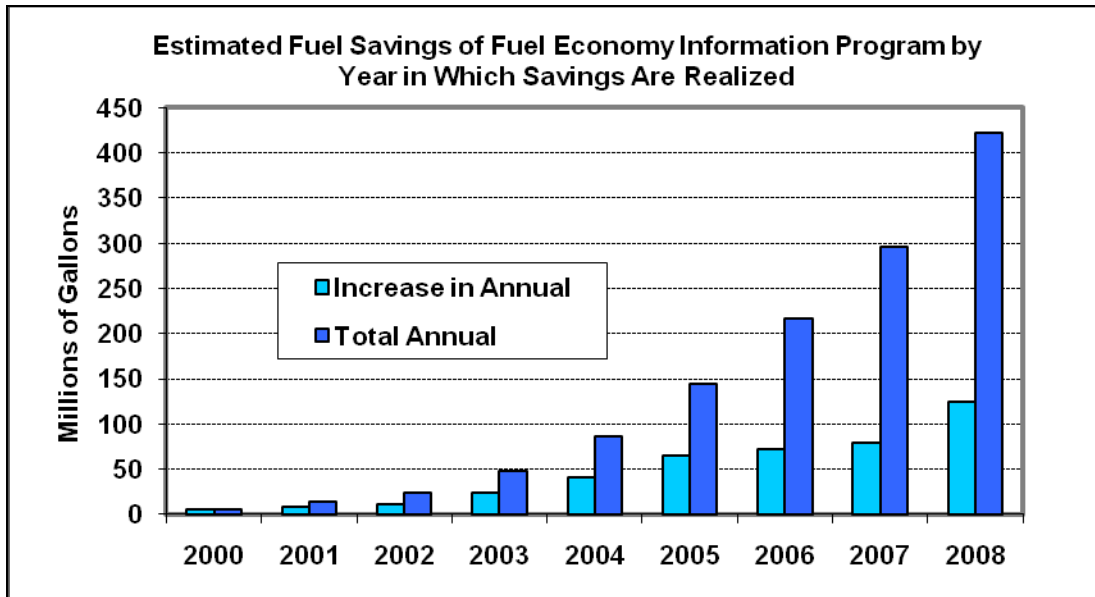


Figure 7. Estimated fuel savings of fuel economy information project by year in which savings are realized.

The over 400 million gallons of gasoline saved represents approximately 4 million metric tons of carbon dioxide emissions avoided.

8. SUCCESSFUL STRATEGIES AND FUTURE CHALLENGES

Four guiding principles have shaped the activities of the Clean Cities Fuel Economy Information Project:

- The primary objective is to serve new and used car buyers and all motorists, to help them make fuel economy decisions in their best interests. This requires input from our customers in the form of focus groups, online surveys and other market research. It also requires intentional promotion of the website through all relevant media.
- The website, gas mileage guide and all our products must be continuously improved.
- Innovation is essential.
- To enhance our effectiveness we must collaborate with the automotive industry, the media, academia, NGOs and other government agencies, most especially the Environmental Protection Agency.

These principles have served to keep the project focused on delivering the best possible service to the public, and they will continue to guide its activities in the future.

The future poses new and challenging opportunities. Research conducted over the past decade

suggests that consumers would give greater value to fuel economy if the uncertainty about future energy savings could be reduced. A key source of uncertainty is lack of confidence in official fuel economy estimates. The problem appears to be that the estimates are inaccurate for many individuals even though they may be unbiased for the population as a whole. This fact indicates that there would be value in developing methods for creating individualized fuel economy estimates. Over the past two years, the Your MPG feature has allowed consumers to identify their driving style, in addition to providing their own estimates of the amount of stop-and-go versus highway driving they do. Most participants also identify the state in which they live. The Fuel Economy Information Program is preparing to carry out a statistical analysis of the over 25,000 Your MPG records submitted to date in order to quantify relationships between easily identifiable factors (city/highway driving, driving style, state of residence, method of measurement, vehicle drivetrain technology) and real-world fuel economy. By taking these factors into account, it may be possible to produce more accurate, individualized fuel economy estimates. If this can be done it should reduce the uncertainty of future fuel savings, thereby increasing their value to typically loss-averse consumers.

Another apparent source of confusion is a consequence of reporting fuel economy in miles per gallon rather than fuel consumption in gallons per 100 miles. Research has shown that many consumers perceive the value of an increase in 10 MPG from 40 to 50 MPG to be equal to a 10 MPG increase from 20 to 30 MPG. In fact, the increase from 40 to 50 MPG reduces fuel consumption by 0.50 gallons per 100 miles while an increase from 20 to 30 reduces fuel consumption by 1.67 gallons per 100 miles. For a vehicle traveling 10,000 miles and gasoline at \$2.50 per gallon, the difference in annual fuel savings is almost \$300. The fueleconomy.gov website provides the option to view fuel economy estimates in terms of miles per gallon, gallons per 100 miles or liters per 100 kilometers. However, this facility is little used by visitors to the website. Additional market research may lead to better strategies for helping consumers understand this important distinction.

In future years, plug-in hybrid vehicles, battery electric vehicles and hydrogen fuel cell vehicles are likely to enter the marketplace, each with a different method of measuring fuel economy. The Clean Cities Fuel Economy Information project can play a key role in helping consumers and the media understand and interpret fuel economy estimates for these new technologies.

As national policy focuses more intensely on protecting the global climate, informing consumers about the consequences of their vehicle choices for greenhouse gas emissions will become increasingly important. EPA and DOT have already begun formulating coordinated policies for regulating motor vehicle fuel economy and greenhouse gas emissions. The Clean Cities Fuel Economy Information Project can contribute to informing the public about the relationships among fuel economy, low carbon fuels, and domestically produced non-petroleum fuels, and how each relates to our national energy goals.

As vehicle technologies evolve, the effects of driver behavior and vehicle maintenance on fuel economy will change. In 2008, the Clean Cities Fuel Economy Information Project initiated research to update the state of knowledge about fuel economy driving and maintenance tips. A key issue is whether in-vehicle fuel economy monitoring devices that provide feedback to drivers

on real-world fuel economy performance actually help improve fuel economy and, if so, how they can be designed and used to best effect. There is some evidence that advanced technologies like hybrid and plug-in hybrid vehicles will be even more sensitive to driving style than conventional vehicles. There is a need to continue and expand support for research in these areas and to develop effective means of informing the public about how to get the best mileage with the smallest impacts on the environment and national energy security.

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